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U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 253.

THE GERMINATION OF SEED CORN.

BY

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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1906.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., March 27, 1906.

SIR: I have the honor to transmit herewith a paper on "The Germination of Seed Corn," prepared by Dr. J. W. T. Duvel, Assistant in the Seed Laboratory.

The purpose of this paper is to emphasize the importance of testing the vitality of individual ears of corn which are intended for seed, and to show how such tests may easily be made by every farmer in his own home. I recommend that this paper be published as a Farmers' Bulletin.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

ILLUSTRATIONS.

253

B. P. I.—210.

THE GERMINATION OF SEED CORN.[a]

THE VALUE OF A GERMINATION TEST.

The importance of testing the vitality of corn which is intended for planting can not be overestimated. It is strange that farmers are willing to plant corn without first being reasonably certain that every kernel put into the ground is capable of producing a good healthy plant.

During the present season more than 90 million acres will be planted to corn in the United States, which will require approximately 15 million bushels of seed. Of this quantity it is almost certain that from 2 to 3 million bushels, or nearly 20 per cent of the corn first planted, will fail to grow as a result of the low vitality of the seed. Thousands of acres will have to be replanted either in their entirety or in part, and many thousands more will grow to maturity with an imperfect stand.

Farmers have so long been accustomed to having a stand under ordinarily favorable conditions varying from 60 to 85 per cent, that many have come to think a stand of 95 per cent or more is impossible. Yet experiments have shown that, barring unfavorable weather at planting time, the work of grubs, wireworms, etc., there is no reason why a stand of corn should be less than 95 per cent. Of recent years, however, the conditions have much improved, and never before has there been such a demand for seed corn of high vitality. A few of our best farmers are beginning to realize that one of the greatest factors in profitable corn production is the securing of seed which will show a high percentage of germination.

If each corn grower would give a little time during the early spring to the testing of his seed, the vitality of each individual ear of corn intended for planting could be readily determined. The poor ears could then be discarded and the 2 or 3 millions of bushels of seed corn which fail to grow each spring could be very profitably converted into pork and beef. However, this is of minor importance in comparison with the increased production of corn which would be made possible in the United States by a judicious selection of the seed ears—weeding out those which are dead or of low vitality.

[a] The writer here wishes to make acknowledgment to the corn growers who courteously furnished the samples of corn for these experiments.

THE AVERAGE YIELD OF CORN TO THE ACRE.

It is difficult to realize that the average yield of corn in the United States in 1905, when the total production was the largest in our history, was only 28.8 bushels of shelled corn to the acre. It is still more surprising to know that the average production per acre is practically the same to-day as it was forty years ago. In fact, the average yield per acre for the ten years from 1866 to 1875 was 26.07 bushels as compared with 25.2 bushels for the ten years from 1896 to 1905. There are several reasons for this, but the principal reason is gross carelessness in the use of seed of low vitality.

During the last decade, corn breeders have achieved marked success in the production of improved types of corn, but unless the farmers throughout the United States take better care of their seed

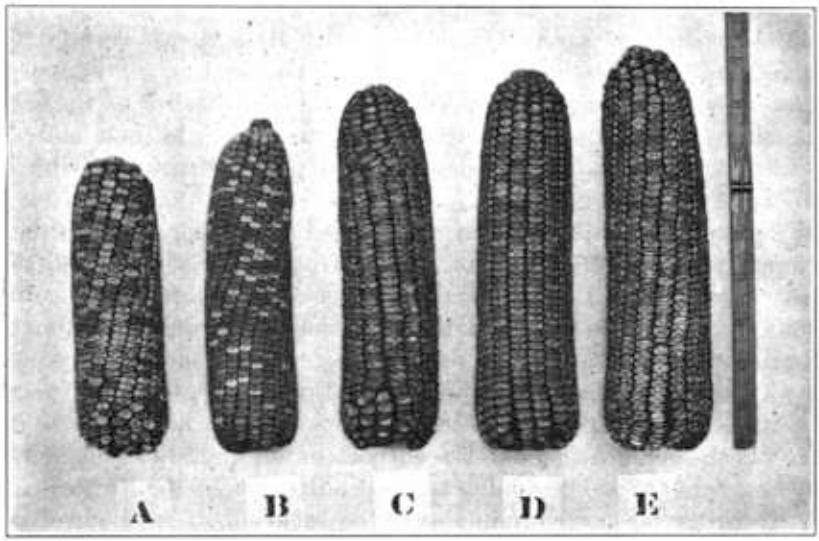

FIG. 1.—Illustration of the yield of corn per acre, allowing a single ear for each hill of 3½ feet: A, 28.8 bushels; B, 30 bushels; C, 40 bushels; D, 45 bushels, and E, 50 bushels.

corn and test each ear separately, preparatory to planting, the chances are that the average yield of corn per acre in the United States will not be materially increased.

In our principal corn-growing States, corn is planted in hills 3½ feet apart each way, giving 3,556 hills per acre. In most sections three stalks to the hill is considered a perfect stand. Yet if each hill would produce but one small ear 6 or 7 inches in length and weighing a trifle more than 9 ounces, the yield for each acre would be 28.8 bushels, the average yield per acre in the United States in 1905 (fig. 1, A).

A single ear to the hill the size of the one shown as B would give an average of 30 bushels per acre; a single ear from each hill similar to the one shown as C would yield 40 bushels per acre; an ear such as D

would yield 45 bushels per acre; while an ear like E, which weighs a trifle less than a pound, would yield 50 bushels of shelled corn per acre, counting only one such ear for each of the 3,556 hills. There are, however, very few farmers who raise as much as 50 bushels of shelled corn per acre. Yet every corn grower can probably produce many ears which are larger than that shown as E in figure 1.

Disregarding both ears D and E and granting that every farmer could harvest from each hill two such ears as the one shown as C, an ear which is less than 8½ inches long and weighs 12.6 ounces, the yield would be 80 bushels of shelled corn per acre. Are there any corn growers who can not produce the equivalent of at least two such ears to every hill? How many grow 80 bushels of shelled corn per acre?

TESTING INDIVIDUAL EARS.

The advantages of testing the vitality of individual ears of corn have been described in various publications,[a] and it is now almost universally admitted by those who have become interested in the vitality of seed corn that the testing of each ear separately is most highly profitable. Experiments have shown that if a few kernels (preferably six) are taken from different parts of an ear of corn and all are found to germinate well—that is, to produce *good healthy sprouts*—practically all of the kernels on that ear will likewise show strong vitality. On the other hand, if a part or all of the kernels tested fail to germinate or show only weak sprouts, the proportion will be the same for all of the kernels on such ears.

The testing of a hundred or more kernels from the entire lot of seed which has been shelled for planting does not meet the requirements, save, perhaps, in a few very special cases.

TIME AND LABOR INVOLVED.

The objection is frequently made that the benefits derived from individual-ear tests do not justify the amount of time and labor expended. This objection, however, is an invalid one and is never made by those who have carefully tested their seed in this way. When it is considered that 12 or 15 ears of corn will furnish enough seed to plant one acre, it can readily be seen that the time and labor required for the testing is extremely small.

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[a] Selecting and Preparing Seed Corn, by P. G. Holden, Bul. 77, Iowa Agricultural Experiment Station, April, 1904; revised December, 1905.

The Testing of Corn for Seed, by Albert N. Hume, Bul. 96, Illinois Agricultural Experiment Station, November, 1904.

Corn Improvement, by A. T. Wiancko, Bul. 110, Indiana Agricultural Experiment Station, January, 1906.

The Production of Good Seed Corn, by C. P. Hartley and Herbert J. Webber, Farmers' Bulletin, No. 229, U. S. Department of Agriculture, 1905.

There are undoubtedly special lots of exceptionally good seed of which an individual-ear test would seem unnecessary, but the tabulated results of such tests as given in the last few pages of this bulletin show that these cases are very rare. By way of illustration, take the sample from Ross County, Ohio, which gave an average germination of 97.3 per cent. Of the seven undesirable ears, Nos. 17 and 36 show a germination of only 70 and 50 per cent, respectively. The five other poor ears each germinated 90 per cent. Granting that each ear contained 800 good kernels which could be used for seed after shelling off the butts and tips, the decreased stand due to the mixing of the seed from these 7 poor ears with the seed from the 42 good ears would be equivalent to 1,200 stalks of corn. If each of these stalks bore an ear weighing only 9.45 ounces (see fig. 1, B), the increased yield on the area planted would be a little over 10 bushels.

The germination tests should be made five or six weeks before planting time, but even if it is necessary to take the plow from the field it is far more profitable to have a good stand of corn on 19 acres than it is to have a poor stand on 20 acres, thereby saving the time and labor necessary to prepare the ground and to plant and cultivate the additional acre. Yet many farmers are every year planting and cultivating 3 or 4 acres in every 20 for which they receive no returns.

SELECTING SEED EARS.

Preparatory to the sampling of the individual ears for the germination tests, it is quite essential that those of desirable type be selected in order to avoid the testing of more ears than is absolutely necessary. This can be best done by arranging the ears on a table or on the floor, or in some such simple manner, so that they can be carefully compared. With the corn spread out in this way the best ears can be removed for seed and the undesirable ears discarded.

REMOVING THE KERNELS FOR TEST.

The number of kernels to be used for the germination test may be varied somewhat, but six kernels taken from different parts of the same ear give reliable results. The kernels from ear No. 1 should be placed in square No. 1 of the germinating box, the kernels from ear No. 2 in square No. 2, and so on. The kernels should be placed germ side up, as shown at C, figure 3.

The kernels can be best removed with a dull pocket knife or similar instrument. Grasp the ear firmly in the left hand, pointing the butt of the ear away from the body. With the knife in the right hand the kernels can be easily removed by forcing the blade down along either the back or the side of the kernels. As the kernel is loosened, grasp it on the opposite side with the thumb and transfer it to the proper

square in the germinating box. The first kernel should be taken about 2 inches from the butt of the ear. Give the ear a quarter turn either to the right or the left and remove the second kernel from the center of the ear. Make another quarter turn and take the third kernel about 2 inches from the tip of the ear. Holding the ear in this same position, take kernel No. 4 about 2 inches from the butt of the ear. Make another quarter turn and take the fifth kernel from near the center of the ear. Make still another quarter turn and take the sixth kernel about 2 inches from the tip of the ear. The ear has now been turned completely around, two kernels have been taken from the butt, two from the center, and two from near the tip of the ear. If the work has been well done each set of two kernels was removed from exactly opposite sides of the ear.

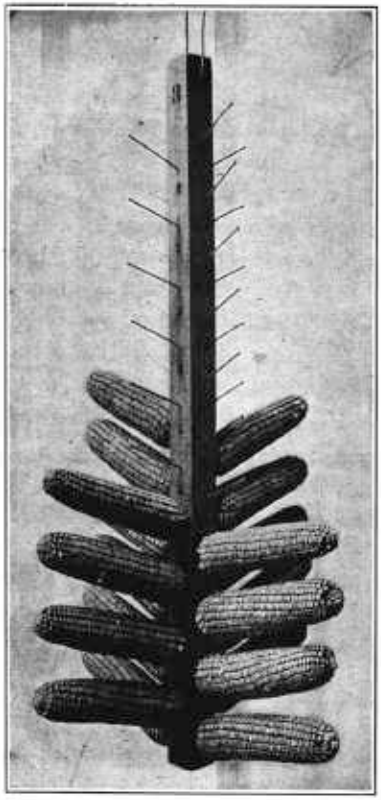

FIG. 2.—Convenient corn-drying rack, which likewise serves for numbering the ears tested for germination.

At the beginning this work will undoubtedly seem laborious and some of the kernels will be injured, but with a little practice the kernels can be removed rapidly and in perfect condition. It must be remembered, however, that the side of the kernels containing the germ is toward the tip of the ear, and care must be taken that the germ is not injured during the sampling.

NUMBERING THE EARS AFTER SAMPLING.

It is important that the ears be numbered or arranged in the same definite order as the corresponding tests in the germinating box. One of the most satisfactory methods is the use of a rack such as is shown in figure 2. This is primarily a drying rack for seed corn, and is extremely simple in construction and likewise inexpensive. The rack shown in the cut is made from a 2 by 2 inch piece of Georgia pine, but a branch from an old apple tree will serve fully as well. After the kernels from the first ear have been placed in square No. 1 of the germinating box, the ear is shoved on nail No. 1 of the drying rack,

ear No. 2 on nail No. 2, and so on. These racks can then be suspended in some suitable place and there need be no fear of the ears being mixed while the germination test is in progress.

THE GERMINATING BOX.

Many kinds of germinating boxes and methods for testing seed corn have been described in various publications from different sources, any one of which will give good results if properly handled. However, it is believed that a box similar to the one shown in figure 3 possesses some advantages and will give good results in the hands of almost any operator.

A germinating box as shown in figure 3 can be made in a few minutes' time from any boards picked up about the cribs or other farm buildings. The box should be about 1½ or 2 inches deep inside and the length and width such as to suit the needs of the individual farmer, but it should not be made water-tight. The box shown in figure 3 is

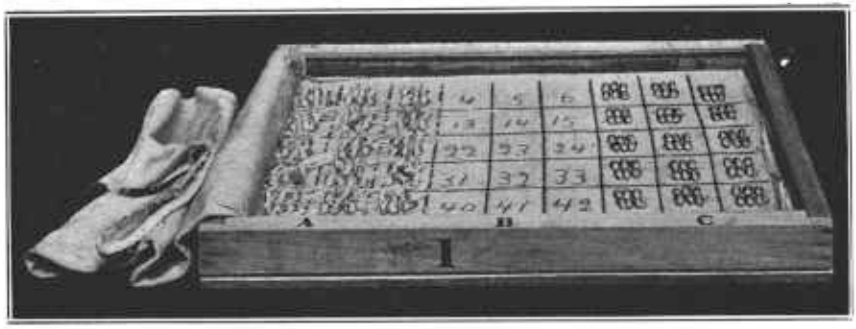

FIG. 3.—Homemade germinating box for making individual-ear tests.

18½ inches long and 12½ inches wide, inside measurement, and affords sufficient space for the testing of 54 ears of corn at one time. Instead of filling the box with sand, soil, or sawdust, as is commonly recommended, the seed bed is made of heavy canton flannel or similar material, having two or three thicknesses of cloth in the bottom of the box and one or two thicknesses of cloth for covering the kernels after the squares have been filled. A new cloth should be thoroughly washed before using.

If canton flannel is to be used, it is well to bear in mind that it comes 27 inches wide. A box of the dimensions above given is just the right width for the canton flannel once folded, allowing for shrinkage. With a lead pencil, mark the cloth into squares 2 inches each way, as shown in the illustration.

For use, first wet the cloth thoroughly by soaking in water and then place the half of the cloth, double thickness, which has been marked in squares, in the bottom of the germinating box. The kernels from ear No. 1 are then placed, germ side up, in square No. 1,

and so on, as already described. When all of the squares have been filled, fold the other end of the cloth carefully over the kernels. If during the sampling the cloths have become dry, sprinkle them well with water. Cover the box with a piece of glass (oileloth may be used) to prevent the evaporation of the water from the eloths, and set the box aside for a few days to await the results of the test.

The principal advantage of a germinating box of this kind is that it is almost impossible to injure the eorn by the addition of too mueh water, as is frequently done where tests are made in soil or sand. Moreover, the entire development of each kernel, both root and stem, can be observed and the sampling ean be done in about one-half of the time required when sand or soil is used.

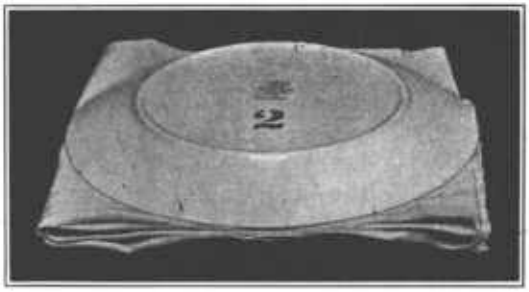

FIG. 4.—Germinating chamber made from two dinner plates.

Where only a limited nnmber of ears are to be tested a similar germinating apparatns may be made by nsing eloth between two dinner plates, as shown in figure 4. Ten-ineh plates will give ample space for the testing of 18 or 20 ears at one time.

CARE OF THE GERMINATING BOX.

If the preliminary work has been well done the germinating box will need but little eare nntil the sprouts are ready for eonnting.

Moisture.—The moisture necessary for germination is supplied from the wet cloths, and *in most cases the first wetting will be sufficient to complete the test.* However, if at any time the cloths beeome dry they should be moistened by sprinkling a little water over the top. If a piece of glass is used for the cover, as recommended, the amount of water condensed on the under side of the glass will usually show whether there is a laek of moisture.

Temperature.—Corn germinates best at a temperature alternating between 65° and 85° F., representing in a way what aetually takes place in nature, the higher temperature prevailing from 4 to 6 hours during the day and the lower temperature at night. Temperatures such as are found near the stove or furnaee in an ordinary country home approach these conditions quite well. It is important, however, that the temperature does not get too low during the night; a drop much below 55° F. will seriously affect the reliability of the test.

COUNTING THE SPROUTS.

The kernels should begin to germinate freely about the third or fourth day, but the counting should not be done until the sixth or seventh day, or until most of the shoots or stems are from 1 to 1½ inches long. This part of the testing must be done with considerable care and requires good judgment, as kernels will be found in all stages of development. The thoroughness of the testing depends on proper selection at this time.

EARS TO BE SAVED FOR SEED.

If the six kernels in any one square in the germinating box show six good healthy sprouts, the ear which they represent should be taken for seed. If one of the six kernels fails to germinate, or gives even a weak root or stem, the ear which it represents must be discarded as unfit for seed. There will also be cases in which all six kernels have germinated, but will be lacking in vigor. Under the most favorable conditions kernels of this kind might produce a good ear of corn, but as the chances are that they will never develop, or else will produce only a barren stalk or perhaps a nubbin, such ears should not be used for seed. It is thus only necessary to remember that all ears showing dead kernels or weak and poorly developed sprouts must be discarded and *only those used for seed in which every kernel tested has given a good healthy sprout.*

THE FINAL GRADING OF THE SEED EARS.

The ears which have shown a perfect germination are now ready to be butted and tipped and shelled for planting. In order to insure further uniformity in planting it is advisable to sort the ears before planting into two or three grades, according to the size of the kernels. This grading may be done by screening, if more convenient.

RESULTS OF GERMINATION TESTS.

The results tabulated in the following pages show the importance of making individual-ear tests for vitality. Ten kernels from each ear were used for these tests, and only those were counted as good which produced strong, healthy sprouts.

A study of these results should convince any corn grower that a little time given to work of this kind is of the greatest value, and that he can not afford to neglect this part of his work during the spring.

TABLE I.—*Percentages of germination of seed corn, individual-ear tests of ten kernels each from crop of 1905.*

Number of ear.	State and county from which samples were received.												
	Colorado.	Connecticut.		Georgia.	Illinois.						Indiana.		
	Washington.	Fairfield.	Windham.	Bartow.	Boone.	Clinton.	Lawrence,[a]	Macon.	Peoria.	Vermilion.	Carroll.	Dekalb.	Jackson.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1	100	100	80	100	100	90	100	100	80	100	70	90	100
2	100	100	100	90	100	100	60	100	90	90	70	80	90
3	80	90	90	100	100	90	80	100	100	100	70	90	100
4	90	100	100	100	100	100	70	100	100	90	80	100	90
5	100	40	90	90	100	100	80	100	90	100	90	90	90
6	100	90	90	100	100	100	80	100	100	100	90	90	100
7	100	90	100	100	100	100	90	100	100	100	90	100	100
8	80	50	100	80	100	100	90	100	90	100	90	90	90
9	100	90	100	90	80	100	90	100	70	100	40	100	100
10	80	100	100	100	90	100	80	90	100	90	90	90	60
11	70	100	90	100	100	100	70	100	80	90	90	100	80
12	80	100	100	100	100	100	80	100	80	100	50	100	100
13	100	100	100	70	90	100	90	90	80	100	90	90	90
14	100	100	90	90	80	100	60	90	90	100	70	90	100
15	90	100	100	80	100	100	100	100	80	90	80	80	80
16	90	100	90	90	100	100	100	90	100	90	30	100	100
17	80	100	100	100	90	90	80	100	80	100	100	100	100
18	80	90	100	80	90	100	40	100	90	100	80	90	100
19	40	80	80	90	100	100	100	90	100	100	30	90	70
20	100	100	80	100	100	80	90	100	100	100	80	90	90
21	100	90	90	100	100	90	90	100	100	100	100	100	100
22	100	100	90	100	100	100	80	100	70	90	50	100	100
23	100	90	100	100	100	100	80	90	90	100	100	90	80
24	70	100	100	80	100	100	70	100	80	100	100	100	90
25	100	100	90	100	100	100	80	80	80	70	100	100	80
26	100	100	80	90	100	100	100	100	90	[b]90	80	[b]100	80
27	100	90	90	100	100	100	90	100	80	80	90	90	70
28	90	100	100	100	100	100	100	90	80	100	100	90	100
29	100	90	90	100	100	100	100	90	100	90	90	100	60
30	100	90	80	100	90	100	100	100	100	90	100	100	80
31	100	60	100	70	100	100	80	100	90	80	100	100	80
32	100	90	90	40	100	100	80	100	90	100	80	100	90
33	90	100	100	90	90	100	80	80	90	100	50	100	60
34	70	100	100	100	100	100	100	100	100	80	100	70	80
35	100	50	80	100	100	100	100	100	0	80	80	80	90
36	100	100	70	100	90	100	90	100	100	100	0	100	100
37	80	100	100	90	100	80	100	100	100	100	80	90	90
38	90	100	100	80	90	90	100	100	100	80	80	100	100
39	90	90	90	100	100	100	100	90	70	0	100	100	80
40	90	80	100	100	90	100	90	80	100	90	80	90	50
41	100	100	100	100	100	100	80	100	80	100	70	100	100
42	90	100	90	80	90	100	90	90	100	100	40	100	100
43	100	70	100	100	100	100	100	90	100	100	100	100	100
44	50	90	100	100	100	100	100	100	80	90	70	100	100
45	40	90	100	100	100	100	90	80	90	90	30	80	100
46	80	50	100	100	100	100	70	100	100	100	90	90	80
47	100	100	90	70	80	90	70	100	100	100	100	90	70
48	80	30	90	100	100	100	30	100	100	90	30	90	80
49	80	60	90	90	90	90	80	100	90	100	90	90	80
50	70	80	100	80	100	100	80	100	90	90	80	100	80
General average	88	88	93.6	92.2	96.6	97.8	84.6	96.2	88.8	92.4	76.8	93.8	87.4
Average of good ears	100	100	100	100	100	100	100	100	100	100	100	100	100
Average of poor ears	77.7	76.4	86.7	81.4	88	87.8	78	86.1	80.7	82.7	69.5	87.6	79.3
Gain by discarding poor ears	12	12	6.4	7.8	3.4	2.2	15.4	3.8	11.2	7.6	23.2	6.2	12.6

[a] Two varieties, mixed.

[b] Change in variety of corn.

TABLE 1.—*Percentages of germination of seed corn, individual-ear tests of ten kernels each from crop of 1905*—Continued.

Number of ear.	State and county from which samples were received.													
	Indiana.		Iowa.				Kansas.					Kentucky.		
	Montgomery.	Rush.	Decatur.	Floyd.	Hardin.	Marion.	Crawford.	Geary.	Harvey.	Marshall.	Shawnee.	Daviess.	Marion.	Warren.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1	100	100	80	80	90	90	50	100	80	70	30	90	80	80
2	0	80	80	90	90	70	80	70	80	80	40	90	70	100
3	100	100	100	100	90	90	30	70	80	80	60	100	90	70
4	90	100	100	90	20	60	50	70	100	80	80	90	100	80
5	.....	90	100	90	90	100	70	90	90	20	30	60	100	60
6	100	100	80	80	90	100	0	90	70	20	70	50	100	80
7	90	100	.....	100	60	20	60	100	80	70	80	70	90	50
8	100	90	.....	90	90	100	90	90	70	100	100	70	90	90
9	100	100	100	90	60	90	80	80	80	80	70	70	100	90
10	100	90	100	60	100	100	80	80	80	90	70	100	90	80
11	100	40	80	90	a 90	100	100	80	100	80	80	60	100	60
12	50	100	.....	100	100	100	100	80	80	70	100	90	100	100
13	40	80	80	70	90	80	80	80	100	90	90	100	90	80
14	100	100	80	100	70	100	100	100	70	80	80	70	100	90
15	100	80	100	100	90	90	90	60	100	90	100	100	100	90
16	90	100	100	90	100	100	100	60	90	60	50	70	80	60
17	90	100	100	100	80	100	70	70	90	70	100	50	100	100
18	90	100	100	90	90	100	90	80	80	30	80	80	100	80
19	70	100	80	100	100	90	90	100	70	30	90	60	100	70
20	90	100	100	70	100	100	80	90	100	60	80	70	90	80
21	90	100	80	100	80	100	90	100	a 90	50	90	100	60	80
22	100	80	60	100	80	100	90	90	90	80	80	100	90	80
23	100	100	100	100	100	100	0	90	90	90	70	100	100	70
24	100	70	80	100	90	100	90	90	80	90	90	80	100	80
25	90	90	100	90	100	90	30	100	100	100	90	90	100	80
26	90	80	100	a 80	90	100	60	100	80	70	40	90	80	90
27	100	90	80	90	80	100	80	80	90	90	70	.....	90	90
28	100	100	80	100	90	80	90	90	70	70	90	.....	80	40
29	100	100	100	90	100	80	80	80	80	100	90	90	a 100	30
30	90	80	100	70	100	100	90	80	90	90	80	100	90	50
31	80	90	80	20	90	40	a 90	90	90	100	20	80	80	80
32	100	100	100	60	70	20	90	90	90	100	90	90	70	70
33	.....	60	80	90	40	50	90	80	100	100	80	100	90	100
34	90	70	100	100	90	100	80	100	100	80	100	90	80	100
35	0	80	100	70	80	100	.....	80	100	80	100	90	100	10
36	90	50	100	50	90	100	100	100	100	90	90	90	100	10
37	100	90	60	90	40	100	80	80	90	70	100	70	a 100	50
38	100	100	100	80	50	100	100	80	90	100	90	80	70	50
39	90	90	100	100	30	90	100	90	100	90	90	80	70	70
40	100	80	80	80	70	90	60	70	100	90	70	60	70	50
41	100	100	80	100	90	100	a 60	80	.....	90	50	60	80	70
42	50	100	80	40	100	100	70	90	.....	100	100	90	70	70
43	0	90	100	80	90	100	90	80	.....	100	100	70	80	50
44	0	60	60	90	80	90	80	70	.....	90	60	90	70	40
45	100	90	100	90	70	100	70	90	.....	100	80	80	80	20
46	100	70	100	80	80	100	90	50	.....	100	100	100	100	50
47	80	100	40	60	100	100	40	80	.....	.....	60	50	70	70
48	50	90	80	50	20	100	60	80	.....	60	90	90	100	80
49	80	90	100	60	100	100	80	80	.....	60	100	80	80	60
50	100	90	100	80	20	100	90	100	.....	90	100	100	80	40
General average	82.7	88.6	88.9	83.4	80	90.2	75.7	84	87.8	70	78.8	82	88	68.4
Average of good ears	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Average of poor ears	66.8	79.6	75.2	76.3	73.7	72.2	71.7	80	82.5	67.4	72	76.5	80	64.9
Gain by discarding poor ears	17.3	11.4	11.1	16.6	20	9.8	24.3	16	12.2	30	21.2	18	12	31.6

a Change in variety of corn.

TABLE 1.—*Percentages of germination of seed corn, individual-ear tests of ten kernels each from crop of 1905*—Continued.

Number of ear.	State and county from which samples were received.												
	Maryland.		Michigan.	Minnesota.	Mississippi.	Missouri.			Nebraska.			New York.	North Carolina.
	Charles.	Frederick.	Lenawee.	Redwood.	De Soto.	Boone.	Henry.	Livingston.	Franklin.	Gage.	Saunders.	Ontario.	Warren.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1	80	80	90	0	80	90	70	80	60	100	90	80	100
2	100	100	100	100	70	100	90	90	70	100	70	100	90
3	100	100	80	100	90	100	70	90	70	80	100	100	80
4	90	100	100	90	60	90	80	100	80	100	70	90	80
5	100	90	80	90	100	10	40	100	100	100	70	90	90
6	90	90	70	70	70	90	60	100	60	100	10	100	60
7	90	100	80	80	40	70	50	100	100	100	90	100	70
8	100	100	90	40	100	90	90	70	80	100	80	40	70
9	90	100	90	20	80	90	80	90	90	100	70	70	90
10	60	100	100	70	80	100	70	80	80	90	100	70	100
11	70	100	80	0	100	90	100	90	80	100	20	80	100
12	100	100	80	10	100	90	90	100	60	100	90	80	60
13	100	100	100	0	100	100	80	80	70	100	10	30	90
14	100	100	80	50	80	90	90	90	80	100	100	100	100
15	80	100	90	40	50	100	80	100	70	100	100	90	40
16	80	100	[a]100	40	80	90	100	100	100	90	80	100	90
17	30	90	50	50	90	100	80	90	70	90	100	80	100
18	100	100	90	20	90	80	80	90	90	80	80	100	90
19	90	100	80	0	100	100	100	100	90	100	60	50	90
20	80	100	90	80	90	100	100	90	90	90	90	90	80
21	80	70	100	60	90	100	90	100	100	100	20	100	100
22	100	100	90	10	100	50	90	100	100	100	100	100	100
23	100	100	100	40	80	100	80	80	90	80	100	100	80
24	100	100	80	90	80	100	70	90	70	100	90	100	80
25	90	100	100	10	70	100	50	100	60	100	100	100	90
26	[a]100	100	[a]100	0	90	100	90	90	100	100	90	30	80
27	100	90	90	40	100	90	70	90	100	100	80	100	80
28	90	90	90	20	50	100	90	90	100	80	90	100	90
29	90	90	100	0	90	100	20	80	90	100	90	90	100
30	100	90	100	50	90	100	90	100	100	100	100	70	100
31	80	90	80	80	100	90	50	70	90	100	100	90	100
32	80	60	80	80	100	100	90	90	90	100	80	70	80
33	100	100	90	0	40	90	100	90	100	100	90	90	100
34	100	100	100	0	80	100	100	90	70	100	100	100	100
35	80	100	70	90	60	100	60	90	[a]80	100	90	100	70
36	90	100	100	50	70	90	50	100	100	90	60	40	100
37	100	100	60	80	70	100	60	100	100	100	90	100	80
38	100	70	80	80	70	100	100	60	70	100	90	90	60
39	90	100	80	80	80	90	80	80	80	100	70	100	90
40	80	100	100	80	60	100	70	100	80	100	40	100	90
41	100	100	[a]100	0	10	100	80	60	100	90	80	100	100
42	90	100	90	0	20	90	100	70	100	100	100	100	100
43	80	100	100	0	80	100	60	70	70	100	90	100	100
44	100	100	80	0	100	100	90	90	100	100	90	90	100
45	90	100	90	0	60	100	100	90	70	100	80	90	60
46	90	100	70	70	90	100	90	100	100	90	60	90	90
47	100	70	90	0	90	100	70	90	80	100	100	80	90
48	90	90	80	0	100	100	70	50	90	90	100	100	100
49	100	100	100	0	60	90	80	70	100	100	100	100	80
50	100	70	70	10	100	100	80	80	80	100	90	100	100
General average	90.4	94.6	87.8	39.4	78.6	93	78.4	87.8	85	96.8	80.8	87.2	87.2
Average of good ears	100	100	100	100	100	100	100	100	100	100	100	100	100
Average of poor ears	82.2	82	81.2	36.9	71	82.5	73.7	82	77.3	87.5	72.6	74.4	79.3
Gain by discarding poor ears	9.6	5.4	12.2	60.6	22.4	7	21.6	12.2	15	3.2	19.2	12.8	12.8

[a] Change in variety of corn.

TABLE 1.—*Percentages of germination of seed corn, individual-ear tests of ten kernels each from crop of 1905*—Continued.

Number of ear.	State and county from which samples were received.												
	Ohio.												
	Allen.		Auglaize.	Defiance.	Gallia.	Hancock.	Jackson.	Knox.	Madison.	Miami.	Ross.	Tuscarawas.	Wayne.
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
1	90	70	90	90	50	70	90	100	70	90	100	60	70
2	100	80	60	70	80	80	90	90	80	90	100	100	60
3	80	100	70	80	80	100	100	90	100	100	100	20	90
4	100	80	100	90	100	70	100	100	90	100	90	80	100
5	100	100	90	90	100	90	100	100	80	90	100	30	70
6	90	100	100	100	70	80	100	100	90	90	100	60	100
7	80	90	90	70	100	90	100	100	90	100	100	60	80
8	80	100	90	90	100	80	0	90	90	80	100	90	90
9	60	100	100	90	100	90	90	100	90	100	100	80	100
10	100	80	80	90	100	70	100	60	30	10	100	80	90
11	90	80	100	100	80	80	100	100	100	100	100	[a] 80	90
12	100	80	100	100	100	100	100	100	10	100	90	100	70
13	90	90	100	100	100	70	90	100	90	90	100	100	60
14	100	80	100	80	90	20	90	90	90	100	100	70	80
15	80	100	100	100	100	80	100	70	100	90	100	100	90
16	70	90	90	90	100	90	100	90	100	100	100	20	80
17	100	100	100	90	60	90	100	70	80	100	70	80	90
18	80	80	80	100	100	100	100	100	80	90	100	90	100
19	80	80	90	60	100	100	100	100	40	90	100	80	90
20	90	100	100	90	100	70	90	100	70	100	100	100	90
21	100	90	100	90	90	100	90	100	80	90	100	[a] 100	70
22	80	90	100	90	100	70	100	100	100	100	100	100	90
23	90	90	80	100	90	100	100	90	90	100	100	100	100
24	100	90	90	100	100	100	80	100	80	100	100	100	80
25	100	100	90	90	100	90	90	90	90	100	100	70	90
26	[a] 100	90	90	70	100	10	100	90	100	100	100	100	[b] 100
27	90	100	100	70	100	80	100	100	90	70	100	100	80
28	90	80	100	90	100	100	.....	90	40	100	90	70	90
29	100	90	100	70	100	100	100	80	100	100	.....	100	90
30	80	90	100	90	90	100	100	100	90	100	90	90	80
31	100	100	100	90	80	90	100	80	100	0	100	[a] 80	80
32	100	80	40	80	100	100	100	100	70	100	100	100	80
33	70	100	100	70	90	70	100	70	20	100	100	80	90
34	100	90	100	50	100	100	100	90	80	100	100	100	100
35	80	90	100	80	100	100	90	90	40	80	100	70	100
36	80	80	100	80	70	100	60	80	60	100	50	80	100
37	80	80	60	80	70	100	80	0	70	50	100	90	100
38	80	70	90	100	100	100	100	90	90	70	100	70	100
39	100	90	100	100	70	90	100	100	90	100	90	50	90
40	90	80	90	90	10	90	80	70	100	100	100	80	100
41	90	90	100	100	100	80	100	100	70	80	100	[a] 80	80
42	70	100	80	90	90	100	70	100	40	50	100	90	100
43	90	90	100	100	50	80	90	90	50	80	100	70	100
44	70	80	80	80	90	90	100	100	50	100	100	90	100
45	90	80	90	100	100	100	100	90	30	90	100	90	50
46	100	90	80	100	100	100	100	80	70	90	100	80	60
47	80	90	100	100	100	90	100	100	0	100	100	80	100
48	100	90	80	80	90	100	100	20	10	100	100	90	100
49	60	90	100	100	100	100	90	90	50	90	100	70	100
50	90	80	100	100	100	100	100	20	30	100	100	70	90
General average	86.8	88.6	91.4	88.4	89	87	92.2	87	71	89	97.3	80.4	87.6
Average of good ears	100	100	100	100	100	100	100	100	100	100	100	100	100
Average of poor ears	79.4	84.6	81.3	82.4	74.5	76.8	80	76	64.7	75	81.4	72.8	80.6
Gain by discarding poor ears	13.2	11.4	8.6	11.6	11	13	7.8	13	29	11	2.7	19.6	12.4

[a] Change in variety of corn.
[b] Remainder of samples stored under different conditions.

TABLE 1.—*Percentages of germination of seed corn, individual-ear tests of ten kernels each from crop of 1905*—Continued.

Number of ear.	State and county from which samples were received.													
	Pennsylvania.							South Carolina.	South Dakota.	Tennessee.	Virginia.	Wisconsin.	
	Berks.	Bucks.	Dauphin.	Lebanon.	Montgomery.	Montour.	Union.	Florence.	Davison.	Jefferson.	Rockbridge.	Fond du Lac.	Rock.
	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
1	100	100	50	100	70	100	90	100	50	90	90	90	80	90
2	100	90	50	100	100	100	60	30	90	100	90	90	60	80
3	100	100	90	100	80	100	80	90	80	80	100	90	80	90
4	100	100	90	100	70	100	100	100	70	100	80	80	70	90
5	90	100	60	90	70	100	100	.....	80	100	100	90	20	100
6	90	90	100	0	100	100	90	70	70	100	100	90	100	80
7	90	100	100	100	70	100	80	80	60	90	70	90	50	100
8	100	100	80	90	90	100	100	100	90	90	100	100	100	80
9	100	90	80	90	100	100	90	90	90	100	80	80	100	90
10	100	100	90	80	80	90	90	.....	60	100	80	80	100	80
11	90	90	80	100	100	100	100	100	100	100	80	40	80	100
12	100	100	100	100	.....	100	100	90	0	70	90	100	80	100
13	90	90	100	90	100	100	90	90	80	100	80	70	80	90
14	100	100	90	100	90	70	90	60	60	100	100	80	50	100
15	100	100	100	100	100	100	100	90	80	90	90	100	100	100
16	100	90	70	100	90	100	90	60	70	100	80	30	100	100
17	90	100	80	100	100	100	80	100	100	90	100	50	100	90
18	100	100	90	90	70	100	70	90	90	90	80	80	80	90
19	90	100	100	90	90	100	90	60	100	80	80	90	100	80
20	100	100	90	100	90	90	70	50	80	100	100	100	80	90
21	100	100	80	100	50	100	80	100	100	50	90	100	90	80
22	100	0	90	100	50	100	80	70	80	80	90	100	100	90
23	90	100	90	90	90	100	100	100	90	90	80	90	100	80
24	100	100	100	100	90	100	90	.....	60	100	100	100	100	80
25	90	80	80	80	100	80	100	90	90	80	100	90	100	100
26	100	90	90	90	[a] 100	100	80	.....	[a] 100	[a] 100	[a b] 90	80	100	[a] 100
27	100	100	100	100	90	100	90	.....	80	80	100	90	90	90
28	.....	100	100	100	60	100	100	[a] 100	80	90	80	100	90	80
29	100	100	70	90	100	90	90	90	80	90	20	80	10	90
30	100	100	90	100	90	100	100	100	90	90	80	80	100	100
31	100	100	80	100	90	100	80	80	70	0	70	100	100	100
32	90	100	100	80	90	100	70	90	80	80	80	90	100	60
33	100	100	60	90	100	90	100	90	80	20	90	100	100	100
34	100	100	80	90	100	90	50	90	100	90	90	40	100	90
35	100	100	90	90	90	80	90	100	90	10	100	100	100	80
36	80	90	80	100	90	90	80	90	100	10	90	100	100	80
37	90	100	100	100	80	100	100	90	100	100	80	100	100	80
38	90	90	100	90	100	100	90	100	100	10	70	90	100	90
39	80	30	80	100	90	100	90	100	100	80	80	80	100	80
40	100	90	100	100	100	100	70	90	90	20	90	80	100	100
41	100	90	90	100	20	90	80	60	100	70	100	40	100	90
42	100	100	90	100	90	100	80	80	100	90	100	60	100	100
43	100	100	100	100	90	90	100	80	100	10	70	90	100	70
44	90	100	90	90	100	100	90	90	90	80	100	100	100	100
45	100	80	100	90	100	100	90	90	100	80	100	90	100	90
46	100	100	80	100	90	100	90	50	60	80	90	80	100	30
47	90	100	100	80	80	90	90	80	80	100	100	90	100	100
48	100	100	100	100	100	90	90	90	70	40	80	30	100	90
49	100	100	90	100	100	100	100	100	90	90	80	90	100	90
50	100	100	100	100	100	100	90	90	100	90	100	90	100	90
General average	96.3	93.6	87.8	93.4	87.4	96.6	87.8	85.1	83	77.4	87.2	83.4	89.8	86.8
Average of good ears	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Average of poor ears	88.8	78.7	80.9	83.5	79.3	86.9	83.1	79	75.7	67.7	80.6	77	68.1	80.6
Gain by discarding poor ears	3.7	6.4	12.2	6.6	12.6	3.4	12.2	14.9	17	22.6	12.8	16.6	10.2	13.2

[a] Change in variety of corn.
[b] Remainder of samples stored under different conditions.

In the foregoing table are given the results of the germination tests of 3,322 ears of corn which have been saved for planting this spring. The samples represent a number of varieties, different times of harvesting, and different conditions of storage, and undoubtedly show a higher grade of seed corn than is usually planted, as the majority of the samples were selected with special care by the leaders of farmers' institutes in the counties represented. The tests, therefore, show that even our best farmers can greatly increase their yield of corn by determining the vitality of individual ears preparatory to planting.

Of the 67 lots of corn tested, 60 lots showed an average germination of less than 95 per cent, 48 lots showed a germination of less than 90 per cent, and 10 lots of less than 80 per cent. The average germination of both good and poor ears was 86.3 per cent. The poorest lot of corn contained only 2 good ears in 50, with 16 dead ears and an average germination of 39.4 per cent. The two best lots of ears germinated 97.8 and 97.3 per cent, respectively, the former having 41 good ears in 50 and the latter showing 42 good ears in a possible 49.

Of the 3,322 ears tested, 1,416 germinated 100 per cent, that is, every kernel in the germinating box produced a good, healthy sprout. The average germination of the 1,906 poor ears was only 77.7 per cent. The average germination of both the good and the poor ears, the kernels of which would have been used for planting had not these tests been made, was 86.3 per cent, showing that 13.7 per cent was gained by discarding ears of low vitality.

CONCLUSIONS.

(1) Approximately 15,000,000 bushels of corn are required for seed every year in the United States.

(2) The yield depends largely on the vitality of the seed planted.

(3) Make your own germinating box and test the vitality of every ear of corn before planting.

(4) The time required for individual ear tests is very little; 12 or 15 ears will furnish enough seed to plant one acre.

(5) Count the sprouts very carefully; any ear failing to show 100 per cent of good sprouts should be rejected.

(6) Of 3,322 ears tested, 1,906, or more than one-half, were unfit for seed. These samples were taken from ears picked for seed by good, careful farmers, and are evidently much above the average.

(7) Field tests have shown that seed of strong vitality will produce the largest yield of corn.

(8) Granting that the samples tested are representative of the present supply of seed corn, the testing of every ear and the subsequent rejection of poor ears will increase the stand 13.7 per cent.

(9) An increased stand of 13.7 per cent would mean an increased annual yield of 298,140,695 bushels, with a value of $100,739,912.91, calculated on the average yield and price for the last ten years.

253

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